

## CLAIMS

What is claimed is:

1. A method of removing halogenated materials from a halogen-containing environment, comprising:  
introducing at least one gaseous aluminum compound into the halogen-containing environment;  
reacting the at least one gaseous aluminum compound with at least one halogenated material to form a gaseous reaction product; and  
removing at least a portion of the gaseous reaction product from the environment.
2. The method of claim 1, wherein introducing at least one gaseous aluminum compound into the halogen-containing environment comprises introducing the at least one gaseous aluminum compound into an environment having at least one halogenated material adhered to at least one surface associated therewith.
3. The method of claim 1, wherein introducing at least one gaseous aluminum compound into the halogen-containing environment comprises introducing the at least one gaseous aluminum compound into an environment having the at least one halogenated material contained therewithin.
4. The method of claim 1, wherein introducing at least one gaseous aluminum compound into the halogen-containing environment comprises pulsing the at least one gaseous aluminum compound into the halogen-containing environment.
5. The method of claim 1, wherein introducing at least one gaseous aluminum compound into the halogen-containing environment comprises introducing the at least one gaseous aluminum compound into the halogen-containing environment in an amount sufficient to react with the at least one halogenated material.

6. The method of claim 1, wherein introducing at least one gaseous aluminum compound into the halogen-containing environment comprises introducing at least one organic aluminum compound selected from the group consisting of a trialkylaluminum compound, an alane, an alkylaluminum hydride, an alkylaluminum halide, an alkylaluminum sesquihalide, and an aluminum sesquihalide into the halogen-containing environment.

7. The method of claim 1, wherein introducing at least one gaseous aluminum compound into the halogen-containing environment comprises introducing at least one organic aluminum compound selected from the group consisting of trimethyl aluminum, triethyl aluminum, triisobutyl aluminum, triethyl(tri-sec-butoxy)dialuminum, and tritertiarybutyl aluminum into the halogen-containing environment.

8. The method of claim 1, wherein introducing at least one gaseous aluminum compound into the halogen-containing environment comprises introducing dimethylethylamine alane or trimethylamine alane into the halogen-containing environment.

9. The method of claim 1, wherein introducing at least one gaseous aluminum compound into the halogen-containing environment comprises introducing at least one organic aluminum compound selected from the group consisting of dimethyl aluminum hydride, diethyl aluminum hydride; and methyl ethyl aluminum hydride into the halogen-containing environment.

10. The method of claim 1, wherein introducing at least one gaseous aluminum compound into the halogen-containing environment comprises introducing the at least one gaseous aluminum compound into a deposition chamber contaminated with the at least one halogenated material.

11. The method of claim 1, wherein reacting the at least one gaseous aluminum compound with at least one halogenated material to form a gaseous reaction product comprises reacting the at least one gaseous aluminum compound with the at least one halogenated material to form an aluminum halide compound.

12. The method of claim 1, wherein reacting the at least one gaseous aluminum compound with at least one halogenated material comprises reacting the at least one gaseous aluminum compound with at least one of  $\text{NF}_3$ ,  $\text{SF}_6$ ,  $\text{C}_2\text{F}_4$ , chlorine, or  $\text{ClF}_3$ .

13. The method of claim 1, wherein removing at least a portion of the gaseous reaction product from the environment comprises venting the environment or applying a vacuum to the environment.

14. A method of removing halogenated materials from a halogen-containing environment, comprising:  
introducing at least one gaseous aluminum compound and at least one oxidizer into the halogen-containing environment;  
forming a solid aluminum product on at least a portion of at least one surface associated with the halogen-containing environment; and  
incorporating at least one halogenated material into the solid aluminum product to form an inert film on the at least one surface.

15. The method of claim 14, wherein introducing at least one gaseous aluminum compound and at least one oxidizer into the halogen-containing environment comprises introducing the at least one gaseous aluminum compound and the at least one oxidizer into an environment having the at least one halogenated material adhered to a surface associated therewith.

16. The method of claim 14, wherein introducing at least one gaseous aluminum compound and at least one oxidizer into the halogen-containing environment comprises pulsing the at least one gaseous aluminum compound and the at least one oxidizer into the halogen-containing environment.

17. The method of claim 14, wherein introducing at least one gaseous aluminum compound and at least one oxidizer into the halogen-containing environment comprises introducing at least one organic aluminum compound selected from the group consisting of a trialkylaluminum compound, an alane, an alkylaluminum hydride, an alkylaluminum halide, an alkylaluminum sesquihalide, and an aluminum sesquihalide into the halogen-containing environment.

18. The method of claim 14, wherein introducing at least one gaseous aluminum compound and at least one oxidizer into the halogen-containing environment comprises introducing at least one organic aluminum compound selected from the group consisting of trimethyl aluminum, triethyl aluminum, triisobutyl aluminum, triethyl(tri-sec-butoxy)dialuminum, and tritertiarybutyl aluminum into the halogen-containing environment.

19. The method of claim 14, wherein introducing at least one gaseous aluminum compound and at least one oxidizer into the halogen-containing environment comprises introducing dimethylethylamine alane or trimethylamine alane into the halogen-containing environment.

20. The method of claim 14, wherein introducing at least one gaseous aluminum compound and at least one oxidizer into the halogen-containing environment comprises introducing at least one organic aluminum compound selected from the group consisting of dimethyl aluminum hydride, diethyl aluminum hydride, and methyl ethyl aluminum hydride into the halogen-containing environment.

21. The method of claim 14, wherein introducing at least one gaseous aluminum compound and at least one oxidizer into the halogen-containing environment comprises introducing at least one oxidizer selected from the group consisting of oxygen, ozone, water, hydrogen peroxide, and isopropanol.

22. The method of claim 14, wherein introducing at least one gaseous aluminum compound and at least one oxidizer into the halogen-containing environment comprises introducing the at least one gaseous aluminum compound and the at least one oxidizer into a deposition chamber.

23. The method of claim 14, wherein forming a solid aluminum product on at least a portion of a surface associated with the halogen-containing environment comprises forming an aluminum oxide layer on at least a portion of the surface.

24. The method of claim 14, further comprising maintaining temperature and pressure conditions in the halogen-containing environment such that the solid aluminum product is deposited on at least a portion of the at least one surface associated with the halogen-containing environment.

25. The method of claim 14, wherein incorporating at least one halogenated material into the solid aluminum product to form an inert film comprises incorporating at least a portion of the at least one halogenated material into the solid aluminum product to form the inert film.

26. The method of claim 14, wherein incorporating at least one halogenated material into the solid aluminum product to form an inert film comprises forming an adduct between the solid aluminum product and the at least one halogenated material.

27. The method of claim 14, further comprising removing the inert film from the at least one surface.

28. The method of claim 27, wherein removing the inert film from the at least one surface comprises at least partially removing the inert film from the at least one surface by chemical etching.

29. The method of claim 14, further comprising forming a barrier layer over at least a portion of the inert film.

30. The method of claim 29, further comprising removing the barrier layer from the at least one surface.

31. The method of claim 29, further comprising removing the inert film and the barrier layer from the at least one surface.

32. The method of claim 31, further comprising removing the inert film and the barrier layer from the at least one surface substantially simultaneously.

33. The method of claim 29, wherein forming a barrier layer over at least a portion of the inert film comprises forming a silicon oxide layer over the at least a portion of the inert film.

34. A method of removing halogenated materials from a halogen-containing environment, comprising:  
introducing at least one gaseous aluminum compound and at least one oxidizer into the halogen-containing environment;  
forming a solid aluminum product on a surface of a semiconductor substrate present in the halogen-containing environment; and  
incorporating at least one halogenated material into the solid aluminum product to form an inert film.

35. The method of claim 34, further comprising forming a barrier layer over at least a portion of the inert film.

36. The method of claim 34, further comprising forming at least one material layer over the inert film.

37. A semiconductor device, comprising a solid aluminum product having at least one halogenated material incorporated therein.